Ontario

ORDER NO. 89-118

JULY 1989

AGDEX 410/725

Factsheet

INSTALLATION RECOMMENDATIONS FOR A MILK PIPELINE

(Revision of Factsheet "Installation Recommendations for a Milk Pipeline", February 1985)

G.A. Garland, Centralia College of Agricultural Technology

Dairymen planning to install a milk pipeline should consider the following recommendations.

1. **TYPE OF MATERIAL FOR MILK PIPELINE**
   Glass or stainless steel are equally good. Remember to protect pipelines, especially glass, where they cross an alley way.

2. **SIZE OF MILK PIPELINE**
   The minimum size of pipeline should be as shown in the following table:

Minimum Diameter mm (in)	Maximum Number of Units on a Single Slope	Maximum Number of Units on a Double Sloped System
51 (2)	4*	8
64 (2-1/2)	6	12
76 (3)	9	18

** Note:*

(a) In a high producing milk herd, three milker units is the maximum number recommended on a single sloped 51 mm (2 in) milk pipeline.

(b) A 51 mm (2 in) diameter glass line is 51 mm (2 in) inside diameter while stainless steel is 51 mm (2 in) outside diameter.

(c) Milk parlours should have the larger 64 mm (2-1/2 in) or 76 mm (3 in) diameter pipelines installed. If at all possible they should be "low" pipelines; that is, they should be located below the cow's udder.

3. **MILK INLETS INTO MILK PIPELINE**
   Inlets should be located in the top one-third of the pipe. They should be self-draining and self-closing. The inlet should be of a design that prevents air leakage when connecting or disconnecting a unit. The inlet diameter should be as large as the milk hose diameter.

4. **CONNECTORS OR COUPLERS OF MILK PIPELINES**
   Connectors must be sanitary, leak proof and able to hold the pipeline rigidly together with minimum maintenance. Plastic or nylon sleeves used as connectors must be provided with additional pipeline hanger supports located close to the connection, especially at a corner elbow. Stainless steel welded lines are quite acceptable as long as proper stainless steel welding techniques and procedures are followed so as to obtain a smooth weld on the inside surface. Stainless steel welded pipelines should have some removable sections to facilitate internal pipe inspections.

5. **MILK PIPELINE HANGERS**
   The pipeline hanger must support the pipeline rigidly in place but allow freedom of movement by temperature expansion or contraction of the glass or stainless steel pipe. The hanger should be supported from the stall floor or the cow stall hardware, and not be supported from the ceiling, especially in two storey barns whose loads overhead change throughout the year.

6. **SLOPE OF MILK PIPELINE**
   The pipeline should be looped around the stable or parlour and be sloped from a high point towards the milk receiver jar with a minimum slope of 25 mm per 3 m (1 inch per 10 ft) for stainless steel welded lines; and 40 mm per 3 m (1-1/2 inches per 10 feet) for glass and stainless steel lines with coupler connections. The pipeline slope should be checked regularly and adjusted accordingly when necessary.

7. **HEIGHT OF MILK PIPELINE**
   Pipeline should not be more than 2.13 m (7 ft) above the cow platform. If constructing a new tie stall barn or parlour, it is recommended to slope the whole building towards the milk house at the desired slope for the milk pipeline. If possible a low line pipeline is preferred.

8. **LENGTH OF MILK HOSE**
   Keep milk hoses as short as possible (2.74 m (9 ft) maximum). During milking keep loops in the milk hose to a minimum because the milk collecting in the bottom of these loops surging back and forth will cause vacuum fluctation at the teat end. A 16 mm (5/8 inch) diameter milk hose is preferable, especially for high yielding herds. The milk hose should have a good hose holder to facilitate proper positioning of the unit on the cow. The holder should not pinch or kink the milk hose.

9. **MILKER UNIT CLAW**
   The claw should:
   (a) be of adequate size to handle the milk;
   (b) have a means of shutting off the vacuum to the teat end;
   (c) have an outlet the same size diameter as the milk hose; and
   (d) have an air vent which allows a predetermined rate of air into the unit to help move the milk away from the cow and into the pipeline.

10. **(RUBBER) LINERS OR INFLATIONS**
Narrow-bore type are recommended. Material wise a few different types may have to be tried in order to find the best type suited for that individual herd. For best results, liners should be replaced as per manufacturer's recommendation. Vented liners (that is, liners with an air vent which replaces the air vent in the claw) may help reduce back washing of milk onto the teat ends.

11. **PULSATORS**
Various combinations of pulsation rates and ratios are available. Rates of 50 to 60 pulsations per minute and ratios up to 65:35 are recommended as maximum. A ratio of less than 50:50 should never be used. Alternating pulsation (either side to side or front to back) is preferable over simultaneous pulsation because the alternating feature minimizes cyclic vacuum fluctuations at the teat end. Alternating pulsators should not use exactly a 50:50 ratio since there is the danger of cross flow of milk from the closing pair to the opening pair of teat cups. Front to back alternating pulsation with a wider ratio on the back quarters has the advantage of milking out the whole udder at about the same time.

12. **MILK RECEIVER JAR**
Glass or stainless steel may be used. Glass is preferred. A multiple inlet receiver jar is necessary in most cases. If for example a double sloped 51 mm (2 in) diameter line is coming to the receiver jar, then two 51 mm (2 in) diameter inlets to the receiver jar are necessary. The inlets to the receiver jar may be larger than the milk lines emptying into it but never have the inlets smaller. The milk receiver jar vacuum supply inlet should be a separate inlet and should be the same size as the milk pipeline inlets or larger; minimum size 51 mm (2 in).

13. **MAIN VACUUM SUPPLY PIPES**
The pipes supplying vacuum to the milk receiver jar and pipes supplying vacuum to pulsator lines should be sized according to the following table:

Vacuum Pump Size		Pipe Size	
Liters/min	**CFM (ASME)**	**mm**	**inches**
849	30	51	2
1415	50	51	2
2547	90	76	3
2830	100	102	4
4245	150	102	4
5660	200	102	4

The vacuum supply pipe attached to the milk receiver jar may be glass or stainless steel. The vacuum supply pipe must pass through a self-draining sanitary trap with minimum inlet sizes the same as the recommended size of the supply pipe. The vacuum pipe between the sanitary trap and the vacuum reserve tank can be of galvanized steel or PVC (plastic) pipe; size according to above table. Locate vacuum pumps as close to the receiver jar as possible; keep the number of elbows to a minimum.

14. **VACUUM REGULATORS**
A regulator must be able to handle the full-rated capacity of the vacuum pump. The manufacturer's recommendation will have to be followed since the capacities of controllers vary greatly. The **Servo Diaphgram** style regulators are best.

The regulator should be of the adjustable type so that vacuum levels may be raised or lowered as the case may be in that individual herd situation. The regulator should have an effective filtering device(s), which must be relatively easy to service and keep clean. A high vacuum relief valve (set at about 53 K Pa (16 in Hg.))is also recommended for safety reasons; however, if a high vacuum relief valve is not used in the system then a warning device should be used to indicate too high or too low a vacuum level just in case a malfunction should occur in the regulator.

A vacuum regulator is located either in a separate inlet to the vacuum reserve tank or located in the vacuum supply pipe between the vacuum reserve tank and the sanitary trap which supplies the receiver jar with vacuum. Either location is acceptable but be sure that it is also relatively dry and in a dust free area.

15. **VACUUM RESERVE TANK (BALANCE TANK)**
The tank must be self-draining; adequately sized, minimum 23 liters (5 gal) capacity for each milker unit used. The tank must be constructed of durable material to withstand solutions of high concentration of chemical cleaners and sanitizers. No installation should be equipped with less than a 91 liter (20 gal) tank; nor is there any need for a tank larger than 275 liters (60 gal).

16. **PULSATOR VACUUM PIPELINE**
The pipeline should be looped around the milking system with each end of the pipeline connecting into the vacuum reserve tank by its own inlet or looped into an adequately sized Header pipe. Galvanized pipe and a minimum of 51 mm (2 in) diameter are preferred. Milking systems with 12 milker units or more should use 76 mm (3 in) diameter pipe. Keep elbows and tees in the pipe to a minimum. Use risers only if absolutely necessary; automatic drain valves should be fitted on all low points on this pipeline. If PVC plastic pipe is used more hangers may be needed for support than if galvanized pipe is used.

17. **VACUUM PUMP**
The following table should be used as a guideline when sizing a vacuum pump's capacity:

No. of milker Units	Recommended Vacuum Pump Capacity CFM(ASME)		Approx. hp minimum of vac. pump
	L per min	cu/ft/min	
1	990	35	3
2	990	35	3
3	990	35	3
4	1020	36	3-5
6	1475	52	5
8	1870	66	5-7-1/2
10	2265	80	7-1/2

18. **WASH DIVERSION PLUG**
When in the "milk" position make sure that the plug is

of the style which does not restrict the milk pipeline diameter. Some style plugs restrict the pipe's capacity as much as two-thirds.

19. **AUTOMATIC WASHERS**

Learn how the washer operates and find out what you have to do **before** you buy. The basic cycles of a washer are as follows:

(a) after-milking rinse
(b) hot wash
(c) acid rinse
(d) sanitize rinse before milking

The important factors with washing besides using the proper chemicals are temperature and time. Therefore, it is recommended to have an accurate thermometer and watch to regularly (once a month) check the temperature and time of each of the cycles.

The after-milking rinse should start at about 38°C (100°F). The wash cycle (depending on the chemicals used) should start at about 71°C (160°F). However, the most important temperature to consider is the temperature of the solution at the end of the wash cycle. The end temperature should **not** be below 43°C (110°F) after 8 to 10 minutes of recirculation.

The acid rinse should start at about 38°C (100°F) and the sanitized rinse before milking should start about 38°C (100°F).

A water softener might be helpful in cutting down on the amount of cleaners used; also a filter, such as an iron filter may be beneficial. Therefore, have the farm water supply tested for hardness, excessive minerals present, etc.

20. **MILK METERS**

Most milk meters on the market are a restriction to the flow of air and milk, consequently, a drop in vacuum level and vacuum fluctuations at the teat end will undoubtedly occur while using milk meters.

The above statement is not intended to discourage the use of milk meters because the information gained from using a milk meter proves it to be an invaluable management tool. The above statement is intended as a warning for the operator to be on his or her guard at all times while using milk meters; to follow proper milking techniques, to keep hoses going to and away from the meter as short and as loop free as possible.

21. **MILK FILTERS**

No milk filter should be placed in a milk pipeline or hose which is carrying milk and supplying milking vacuum simultaneously. Milk filters should be installed only on the discharge side of the milk pump; usually in the pipe between the milk pump and the bulk tank.

22. **AUTOMATIC TAKE OFFS**

Automatic take offs are becoming increasingly more popular in milk parlours and even in tie stall barns as a labor-saving device. The automatic take off removes the milker unit from the cow once the milk flow has been sensed to be below a certain value. The take offs can range from simple vacuum operated units controlled by milk flow float sensors to sophisticated electronic devices.

In general the automatic take offs should do the following:

(a) they should sense end of milk flow without overmilking;
(b) they must be designed to shut off vacuum to the claw before starting to retract the unit;
(c) they should have as little restriction to milk flow path from claw to pipeline as possible;
(d) they should be easily cleaned in place;
(e) they should be regularly checked for efficiency of removal.

Some milking management points to consider when using automatic take offs are the following:

(a) A milk hose support is necessary to help achieve even milk out between front and rear quarters.
(b) Three quartered cows and cows with problem quarters and slow milking cows, may not be milked out properly using the automatic take off.
(c) Cows must be prepared properly for good milk let down.

23. **FIRST TIME USE OF A NEW MILK PIPELINE**

Before using the newly installed milk pipeline make sure that you know all aspects of its operation. Have the milking equipment dealer present during at least two complete cow milkings.

Measurements, such as vacuum pump capacity, pipeline losses, milker unit operating losses and effective reserve in the system should be taken and recorded for future reference.

During milking, measurements of teat end vacuum levels should be taken from several cows. It is desirable to have a teat end vacuum level in the range of 33 to 40 K Pa (10 to 12 inches of mercury) vacuum. Vacuum fluctuations at the teat end should be less than 7 K Pa (2 in.hg) vacuum.

To accomplish this recommended teat end vacuum level most high pipeline vacuum levels are set at a maximum of 47 K pa (14 in hg) vacuum, and a low pipeline is set at 40 to 42 K pa (12 to 12-1/2 in hg). In no case should the vacuum level be set at more than 50 K pa (15 in hg.).

It should be pointed out that the recommendations given above in this Factsheet are primarily for the installation of conventional milk pipelines using vented type milker units. Milking systems that use two separate vacuum sources (one to milk the cows and the other to transfer the milk) are exempt from some of these recommendations. The exemptions may be obtained by contacting the author of this Factsheet or by contacting the local Ontario Milk Marketing Board fieldman who can obtain the assistance of one of their qualified milking equipment technicians.

12M
ISSN 0225-7882